Space Weather Technical Forecast

Issued on Monday 10 March 2025 at 13:07 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of Isolated M-class flares. Spell of Active to G1 Minor Storms, and chance G2 Moderate storm intervals, expected day 3-4 (12-13 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with only a few minor C-class flares observed. There are six regions on the Earth-facing disc. The main region of interest continues to be AR4019 in the northeast, which has seen gradual growth in its trailer region, including the development of a very weak delta spot. A very small trailer became apparent in the new region moving onto the disc from over the southeast limb. Elsewhere on the disc, the trailer of AR4012 has now faded. The remaining spots are relatively small, simple, and stable currently.

No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: A declining connection to the fast wind of CH21/- was observed. Solar winds, as measured by ACE at L1, have fallen from near 700 km/s to around 520-580 km/s. Density was generally below average, but sporadically rose to average or above at times. Total Interplanetary Magnetic Field, Bt, was Weak throughout. The north-south component, Bz, was also Weak and variable, ranging between +/-6 nT. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity fell from initial Active (Kp4) intervals to Quiet to Unsettled (Kp1-3) thereafter.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background. High energy electron flux (greater than 2 MeV) was generally Moderate, before reaching a High value of 1120 pfu at 09/1150 UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), with 8.77e6 integrated pfu observed at 10/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast, with a chance of Isolated M-class flares.

Solar Wind / Geomagnetic Activity: There are no CMEs expected to impact Earth. However, a very slight glancing interaction cannot be ruled out later day 1 into day 2 (10-11 Mar) from the M1.6-flare CME from 07 Mar, as it passes to the south. Ongoing connection to CH21/- is expected to continue slowly easing, with background or near background winds likely by day 3 (12 Mar). The next fast wind enhancement from CH22/- is then expected late day 3 or day 4 (12-13 Mar). Quiet to Unsettled conditions are expected day 1-3 (10-12 Mar) with a decreasing chance of Active

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intervals. Any fast wind connection later day 3 or day 4 (12-13 Mar) is expected to bring a further spell of Active to G1 Minor Storms with a chance of G2 Moderate storm intervals.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at Background. High energy electron flux is likely to reach High later day 1 (10 Mar), and persist at or near this level until the onset of the next coronal hole enhancement late day 3 or day 4 (12-13 Mar). The associated 24 hour fluence is currently below the Active threshold, but is expected to rise with a chance of reaching Active by day 2 (11 Mar).

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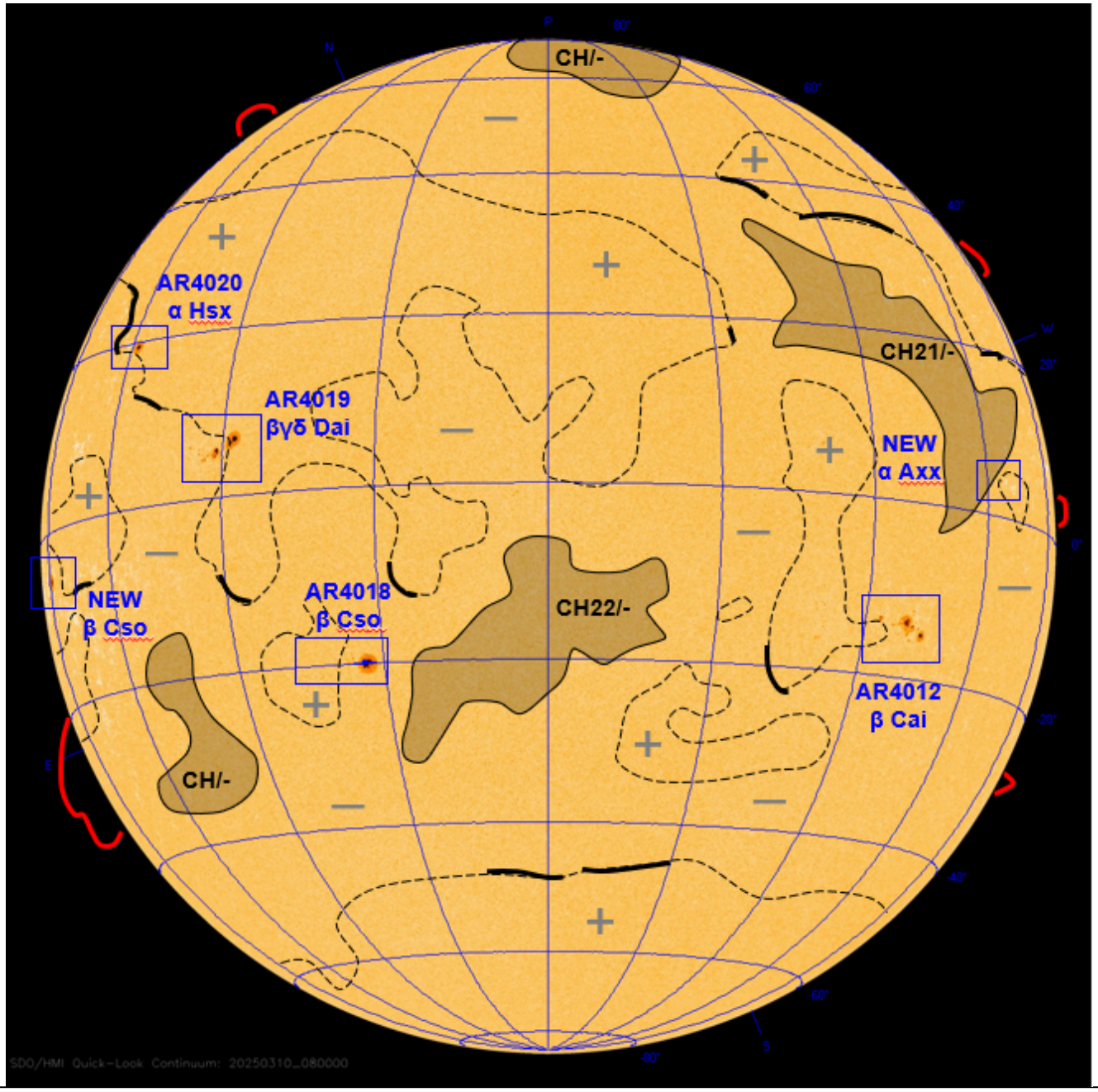
Figure 1: Solar Synoptic Map valid 10/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no CMEs expected to impact Earth, however the CME from the M1.6-flare around 07/2100 UTC is expected to pass close, to the south, and a weak glance cannot be completely ruled out, perhaps later on day 1 (10 Mar) into day 2 (11 Mar).

Ongoing fast winds from CH21/- are expected to gradually ease through days 1-3 (10-12 Mar), with solar winds easing near, or to, background. Geomagnetic activity is expected to be Quiet to Unsettled through this period, with a decreasing chance of isolated Active intervals.

The next coronal hole enhancement, from CH22/-, is expected to occur late day 3 or day 4 (12-13 Mar). This is a little earlier than current MOSWOC Enlil expectations which is considered too fast with the expected enhancement. 27-day persistence is not providing good guidance due to this feature being much reduced in its western extent on this rotation. However once this does connect, due to its near equator southern disc location and its negative polarity, which is favoured for connection to Earth at this time of year, Elevated to Strong solar winds are likely along with a spell of Active to G1 Minor Storms with isolated G2 Moderate storm intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	30	70
Strong	G3	No	1	1	1	2
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
08/0050	Partial	AR4016	34S 06E	825	Missing	Small chance of weak, glancing arrival late 10 Mar into 11 Mar

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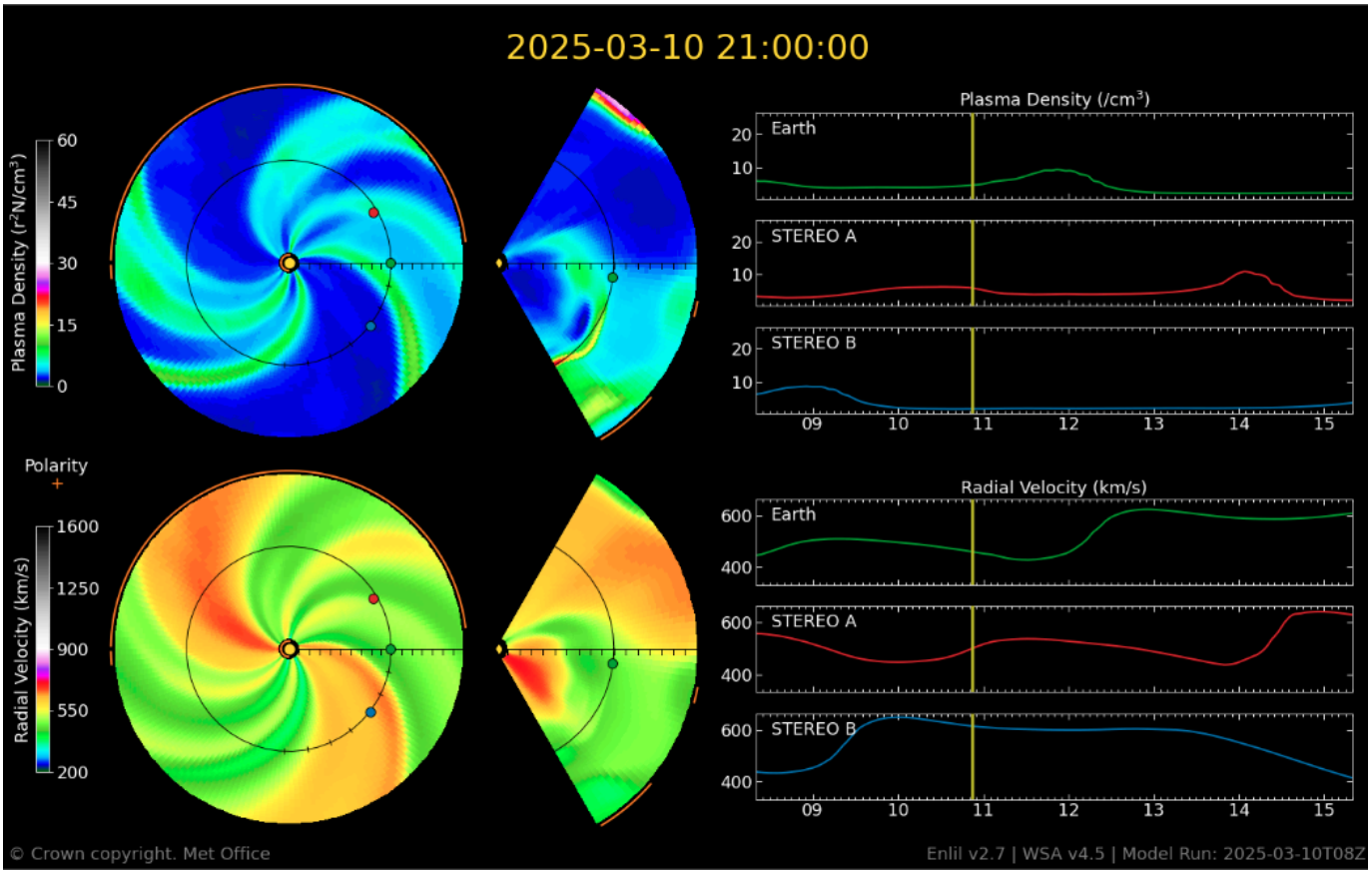
Figure 2: MOSWOC Enlil model showing the bulk of the M1.6 CME passing below Earths orbit.



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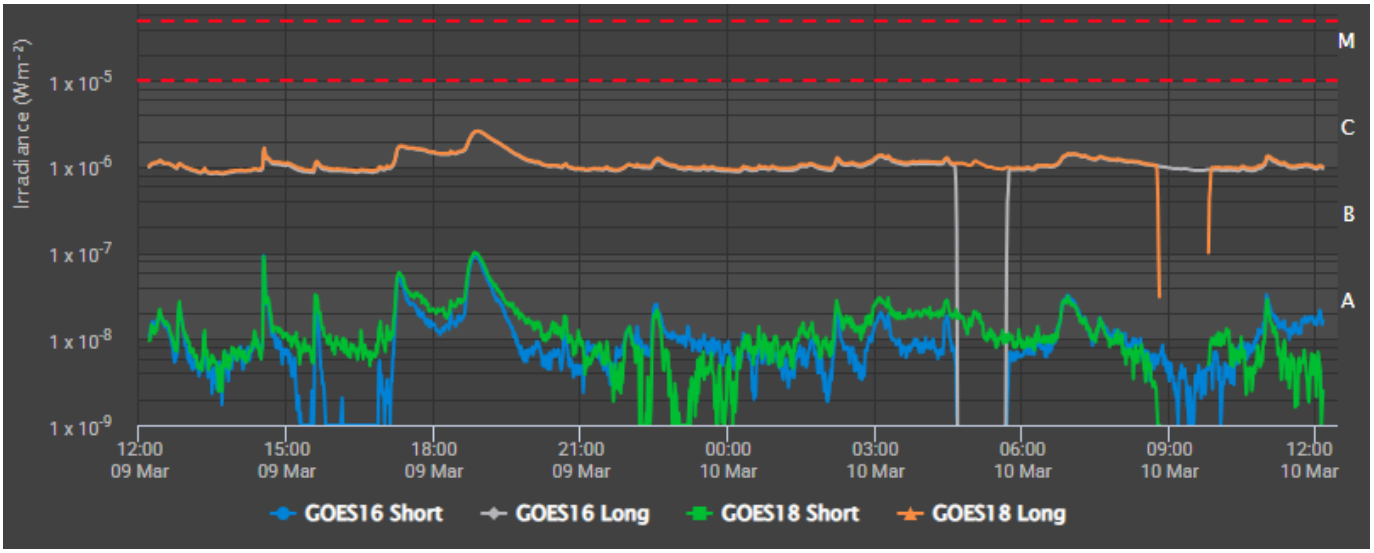
Radio Blackouts - X-Ray Flares

Solar activity is generally Low with only a few minor C-class flares observed. There are six regions on the Earth-facing disc. The main region of interest continues to be AR4019 in the northeast, which has seen gradual growth in its trailer region, including the development of a very weak delta spot, although the region remains relatively small. Some very slight growth was also evident in the trailer of AR4018, and a very small trailer became apparent in the new region moving onto the disc from over the southeast limb. Elsewhere on the disc, the trailer of AR4012 has now faded. This has now been assessed as a smaller region that only just maintains a bipolar configuration due to a single weak negative spot. The remaining spots are relatively small, simple, and stable currently.

Low to Moderate activity is forecast, with a chance of isolated M-class flares, most likely from AR4019 as it slowly develops on the northeast disc.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	30	30	40	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: GOES-16 & -18 X-ray flux.



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Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is expected to persist at Background, with the current regions on the disc unlikely to produce events that would give a notable enhancement.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

The high-energy electron flux (>2MeV) as observed at GOES16 is expected to show a rising trend as solar winds ease from the recent fast wind connection. This will lead to mainly Moderate flux, and an increasing chance of persistent High flux from later on day 1 (10 Mar). Confidence is low for the longevity of this high flux however due to the potential fast wind onset from CH22/- later on day 3 and into day 4 (12-13 Mar), along with the very slight chance of a CME glance later day 1 into day 2 (10-11 Mar), providing the potential for drop out of the observed flux at GEO.

The associated 24 hour integrated fluence is subsequently expected to rise through days 1-2 (10-11 Mar), before seeing either a levelling trend, or perhaps declining thereafter. Both 27-day recurrence and the MOSWOC REFM are currently giving good guidance for the rising trend, although this is likely underestimating the peak fluence, which has a chance to rise above the Active threshold later day 2 (12 Mar).

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	10	40	40	20
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: GOES-16 Electron flux.

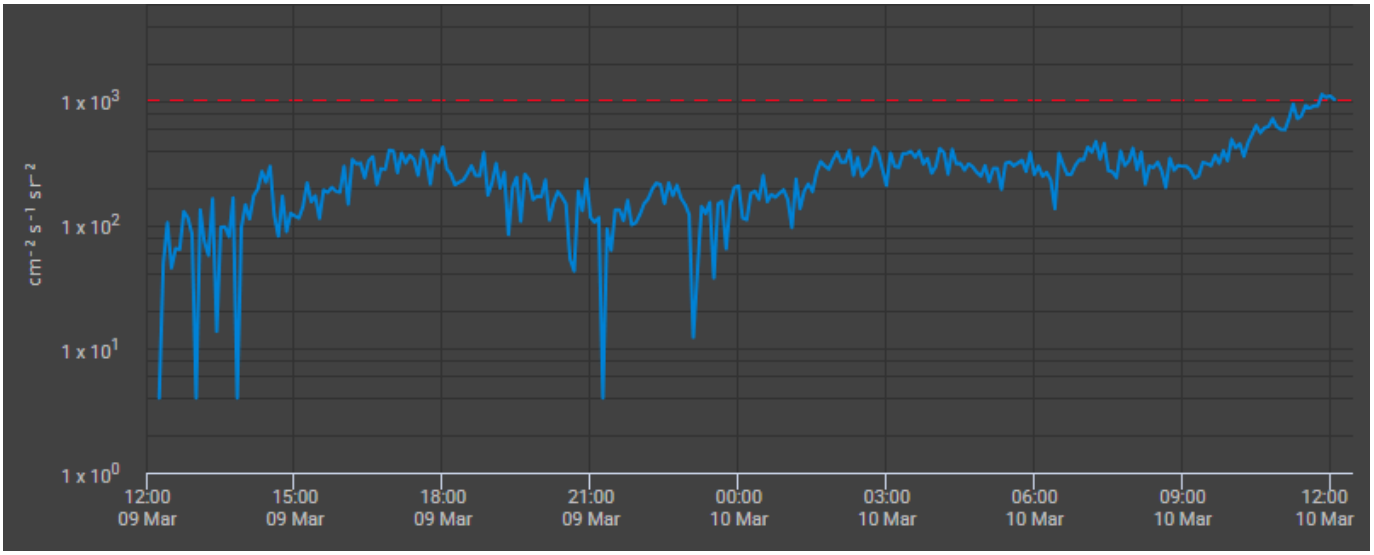

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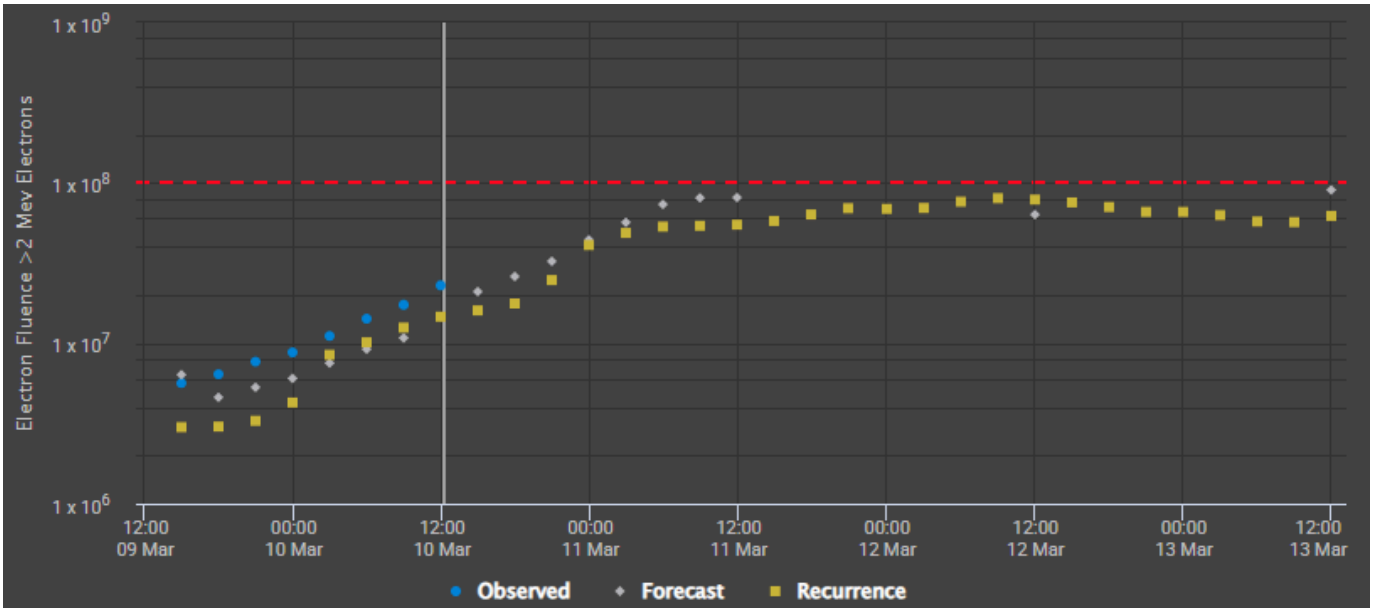
Figure 5: MOSWOC REFM, showing the gradual trend upwards in fluence over the next couple of days, although perhaps underplaying the max fluence, with a chance for the Active threshold to be met on 11 Mar.



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